Superpave – It's Not Just

From county roads to city streets, Superpave is proving its usefulness

By Dan Brown

State Road 91 near Ogden, Utah is a good example of a local road paved with Superpave.

With all due speed, local road agencies in many states are adopting Superpave, the new federal system for designing Hot Mix Asphalt (HMA) pavements. While the road to Superpave is usually not perfectly smooth, most local agencies like its results. Agencies report that it does, in fact, produce Superior Performing Asphalt Pavements – the name for which Superpave stands.

"Superpave is good but it requires a little more technique in construction," says Dan Kiley, inspections coordinator, Public Works Operations for the city of Virginia Beach, Va. "You have to roll the pavement right behind the paver, for example."

Superpave was the outcome of the Strategic Highway Research Program (SHRP), which was a series of federally funded research contracts awarded in the late 1980s by the American Association of State Highway and Transportation Officials. The end result is a mix design method that employs a new system for grading asphalt cements and analyzes volumes of aggregates, air voids, and asphalt cement to create the mixture. A key element of Superpave is the compaction design process, which uses a gyratory compactor to arrive at a design density.

A primary outcome from SHRP became the performance grading (PG) system for asphalt cements (AC). Under Superpave, AC grades are specified for different regions and climates according to upper and lower temperatures. An AC labeled PG 64-22, for example, is designed to provide rutting resistance at 64 degrees Celsius and durability against cold-weather cracking at minus 22 degrees Celsius.

In many cases, the rate of local agencies' Superpave adoption follows directly from the lead of the respective state transportation department. "I had the impression that Superpave was a wonderful mix but mostly for Interstates and high-type highway facilities," says Bob Turner, director of public works, city of Little Rock, Arkansas. "We were brought into it by the Arkansas State Highway and Transportation Department. It took me by surprise when I was told that we would be using Superpave on a local urban street – a four-lane, four-block project. It has performed very well."

Custom-designed

One advantage of the Superpave system is that it allows a pavement to be designed for the specific traffic loading and climate of any particular road – and that includes low-volume local roads. As designed by the Strategic Highway Research Program and modified by the National Center for Asphalt Technology, Superpave has four levels of mix design. Level 1 mixes are designed for the lowest traffic volumes (less than 0.3 million equivalent single axle loadings, or ESALs). There are variations on this system, but generally, Level 1 mixes have a design compaction level of 50 gyrations per specimen in the gyratory compactor. The other three

This article was adapted from an article that appeared in the February 2003 issue of *Public Works* magazine.

for Highways Any More

levels stack up as follows:

- Level 2 – 75 gyrations – 0.3 million to 3 million ESALs.
- Level 3 – 100 gyrations – 3 million to 30 million ESALs.
- Level 4 – 125 gyrations – more than 30 million ESALs.

In many states, local agencies' success with Superpave stems from an educational program staged by the state DOT acting in concert with the industry as represented by the respective state asphalt pavement association. Workshops, conferences, and direct consulting assistance have been offered and continue to be available from the state DOTs and the state associations.

"The Virginia Asphalt Association put on classes and seminars," says Kiley of Virginia Beach. "I didn't just want to Superpave everything. I wanted to make sure we were doing the right thing. We tried (Superpave) and we've been very happy with it."

Across the nation

Following are brief snapshots of local agencies' experiences with Superpave in states with a range of climates and conditions from Minnesota to North Carolina.

Arkansas. Atlas Asphalt Inc., a Jonesboro-based contractor, has used Superpave for local agencies since 1997, reports Rick Rose, quality control manager for the firm. A standard mix for low-volume local roads has a 12.5-mm nominal maximum aggregate size (NMAS) with 5.4 percent asphalt cement (AC). "If we lay the 12.5-mm mix at 2 inches thick, we can get good compaction," he says.

"You can get into some problems with permeability with Superpave, if you use it on a county road out here without a good asphalt base or granular base," says Rose. His solution: "If we have a concern that a pavement has an inadequate base, then we'll use a tighter mix, and in some of those cases we may go with a Marshall mix."

Iowa. This state has a partnership between the industry, as defined by the Asphalt Pavement Association of Iowa (APAI) and the state's transportation department. The partnership is called the Quality Management-Asphalt (QM-A) group. In 1999 it charged a small task force with developing an implementation plan for a gyratory-based design procedure.

"The heart and soul of the implementation plan is an analysis of 102 existing Marshall mixes that the counties knew performed well," says Mike Heitzman, state bituminous engineer with the Iowa DOT. "From that analysis the QM-A implementation people were able to generate a set of criteria by which to characterize the 102 mixtures in gyratory terms.

"We're not changing the mixes they're using," says Heitzman. "All we're doing is using a different mix design process to get the same mixture." Last year, counties voluntarily used the new Iowa Gyratory Mix Design method on more than 40 projects – a high percentage considering that about half of Iowa's 99 counties do an HMA project each year, Heitzman says. (The state eschews the term Superpave.) "As part of the implementation plan, it was agreed that the Iowa DOT would no longer support Marshall mix designs as of the 2004 construction season," says Heitzman.

A key to success has proved to be a materials selection guide that helps county engineers select the right mix for a given road. Because county engineers don't have a way to arrive at an ESAL count for low-volume roads, "I developed a simplified method of determining ESALs – a fudge factor, if you will, to correlate the percentage of trucks to ESALs," says Heitzman.

Maryland. In 2000, Baltimore County switched to Superpave from the Marshall method, says Mark Benner, chief inspector for the county's Bureau of Highways. The county started by using Level 2 mixes, even on low volume roads, and encountered difficulty getting sufficient compaction in thinner lifts, says Benner. The solution proved to be the use of Level 1 mixes, which have more AC in them, at 5.5 percent, compared to 5.0 percent for Level 2 mixes. "Now we're getting 94 percent density instead of 92 percent," says Benner. "The increased asphalt content allows you to get simpler, easier compaction."

The county still uses Level 2 mixes for higher-volume roads. "We don't have any easy way to figure ESALs," says Benner. "For a busier road we'll use a Level 2 mix. One of the benefits of Superpave is that you can pick a design with your correct binder for the level of traffic you've got. We were able to find that design within the Superpave system."

In Harford County, Maryland, "We were using Level 2 and Level 3 mixes and we switched down to the Level 1 mix," says Tom Norris, chief of the bureau of construction management. The county had a problem with tearing failures on Superpave-designed base courses that sat open through a winter. With higher AC contents of 5.0 to 5.4

percent, Level 1 mixes proved to make a better seal than Level 2 mixes with 4.2 to 4.5 percent AC, Norris says. "The problem was segregation of aggregates and a lack of asphalt," he explains.

"Toward the beginning of 2002 we started to use this Level 1 mix and we've had good success with it," says Norris.

Minnesota. Rich Wolters, executive director of the Minnesota Asphalt Pavement Association (MAPA), says local agencies and contractors have been exposed to Superpave technology through an annual Asphalt Conference, a Contractors' Workshop, and various workshops sponsored by MAPA and the Minnesota DOT (MNDOT).

While MNDOT developed a Superpave implementation plan as early as 1995, and followed it up with a Stearns County pilot project, relatively few local agencies have embraced the technology. Wolters says agencies seek test data to correlate the performance and costs of Superpave-designed mixtures to Marshall mixes. "Acceptance by local agencies still has a ways to go, because we have limited performance information for low-volume facilities," says Wolters.

"By fall of 2003, we expect to have new performance data," he says. MNDOT, contractors, and laboratories are testing various mixtures compacted by both gyratory and Marshall methods. The five to six different mix types being tested emphasize low volume pavement designs such as city streets, golf cart paths and driveways. "Pulling the data together will be a joint effort of MAPA and MNDOT," says Wolters.

North Carolina. In January 2002, Don Goins, chief engineer of operations for the North Carolina DOT, announced that as of March 2003, the state would use only Superpave-designed mixtures on all 78,000 miles of state-managed roads. North Carolina annually paves some 8 million tons of HMA, says Cecil Jones, NCDOT state materials engineer.

The requirement means the state will use Superpave for major roads, for maintenance and resurfacing and for subdivisions that are taken over by the state. Says C.A. Gardner, director of technical services for the Carolina Asphalt Pavement Association (CAPA): "The order does not affect city streets, but most cities reference NCDOT specs, so they also will be converting to Superpave."

"Overall, it's going very well," says Gardner. "Some mixes have turned out to be very permeable and it's caused some problems. The immediate solution is that the DOT is going to specify that surface mixes

be fine-graded. That will allow them to put more AC in the mix."

Steve Varnedoe, NCDOT's maintenance and equipment engineer, says the state traditionally has placed a lot of 1-inch overlays. "Then when they came out with the 9.5-mm mixes, you have to place them at 1.25 inches thick," says Varnedoe. Early Superpave mixtures were over-designed for resurfacing low-volume roads, he says. So NCDOT officials worked with CAPA and HMA contractors to design a fine-graded Superpave mixture that is better suited for low volume roads. "With that mix we can place a lift thickness of 1 inch," says Varnedoe.

Virginia. "Our first Superpave project was three years ago, on a street running through Virginia Beach and Norfolk," says Kiley of Virginia Beach. The city milled out a rutted intersection and overlaid it using 2 to 4 inches of a Superpave mix with 9.5-mm top-size aggregate and PG 76-22. Since then, "It has performed very well," says Kiley.

Virginia Beach has launched a program called "Right Time, Right Place, Right Method." The basic idea is to gain the maximum life extension with the minimum expenditure. The city employs a pavement management system whose goal is to recommend maintenance/rehabilitation procedures to extend the life of the pavement before extensive rehabilitation is needed. "If you catch a pavement at the right time, you can really save money in the long run," according to Kiley.

Under the new program, the city might identify a residential street that has deteriorated only to the level of a 7, with 10 being a new pavement. "We mill it 3/4 to 1 inch and put back 3/4 to 1 inch of a fine Superpave mix using PG 64-22," says Kiley. "Now, instead of having to pay $25,500 per lane mile for a 1-1/2-inch overlay, I'm paying $14,400 for the thin overlay. I can do twice as much pavement with a ton of Hot Mix – and get my road back to a 10. This way we can get another 12 years out of the pavement." *HMAT*

Dan Brown is the owner of TechniComm, a Des Plaines, Illinois communications business specializing in the construction industry.

NAPA has practitioner-oriented tools to help with the unique challenges encountered in designing, producing, placing, and compacting Superpave mixes. Order the publication ***Superpave Construction Guidelines*** ($12) and the video ***Understanding Superpave Mix Design: HMA for Year 2000+*** ($40) via NAPA's toll-free number, 888-468-6499; via fax, 301-731-4748; or via e-mail, publications@hotmix.org.